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Switch

Abstract:

Abstract of GB 2131543

(A) Translate this text In a switch, optical radiation from a radiation source 3 is supplied via photoconductor fibres 8, which are partially sheathed, to a radiation receiver 5 and is preferably manually acted upon. The photoconductor fibres 8 lie adjacent to one another on a contact surface 2 and the photoconductor fibres have no sheathing on the side lying opposite the points of contact of the photoconductor fibres with the contact surface.

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(54) Switch

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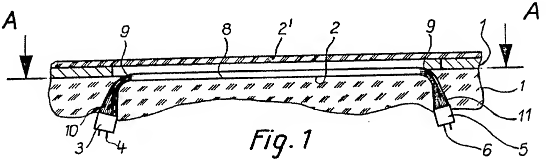

Fig. 1

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

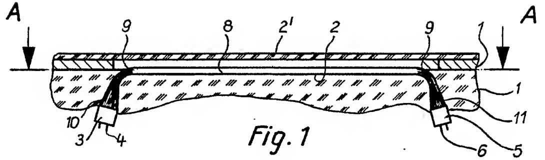

Fig. 1

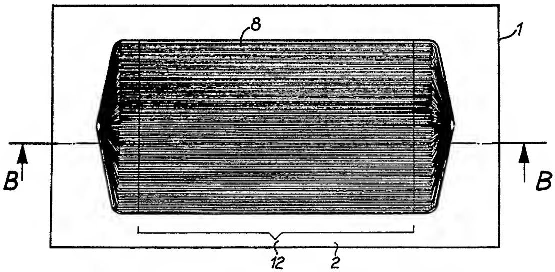

Fig. 2

Fig.3

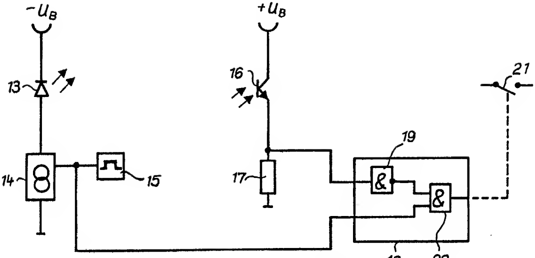

Fig. 4

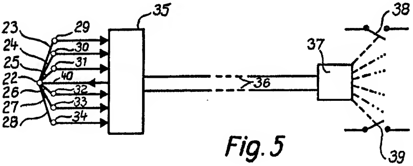

Fig. 5

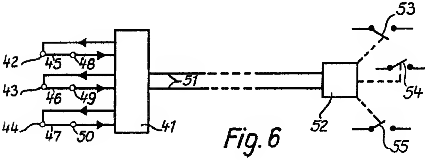

Fig. 6

SPECIFICATION

Switch

The invention relates to a switch, in which the optical radiation from a radiation source is supplied to a radiation receiver by means of photoconductors.

Sensor switches are already known, in which switching is achieved by the use of the Hall effect. As in the case of the change of distance between the components used, a Hall generator with threshold value release is subject to a change in potential, electrical means for evaluating this change must be additionally provided. In addition, mechanical means which keep to tolerances are required for the change of distance itself, which means involve, on one hand, a bulky type of construction and require particular protection, on the other hand, in chemically or physically active atmospheres.

Other known switch elements use a contact which is preferably located in an inert gas atmosphere and which opens and closes under the effect of a variable magnetic field. Apart from the fact that mechanical or electrical means must also be provided in this case in order to modify the intensity of the magnetic field acting on the contact, it is impossible to avoid circuit techniques preventing vibration of the contact and the use of precious metals or earth metals, i.e. metals which are costly, for the manufacture of the contact.

In addition, sensor switches are known, in which a current flow takes place between two contact surfaces via the skin resistance of the human body in order to control making of the contact. In other cases the leakage current from a contact surface is evaluated via the human body as an electrical earth. Although these sensor switches do not involve the use of bulky mechanical means for the change of distance between individual components, the physical stress on the human body connected therewith on actuation of the sensor switch must be considered to be disadvantageous and stressful.

In addition, rare or precious metals are required to prevent corrosion effects on the contact surface of the switch. Input devices having no contacts for the manual input of data into electrical appliances are also known in which the radiation from one or more radiation sources contacting radiation sensitive energy converters is acted upon geometrically. This arrangement is very costly to construct and very susceptible to soiling.

In a further type of construction movable mechanical components are used in order to act upon the radiation guide, which components must increase the volume of the input device and which must themselves be constructed with suitable accuracy to size in order to avoid jamming and crushing.

Lastly it is known to use optical fibres for the input of data into electronic appliances. In these cases a geometric division of the radiation guide also takes place by separation of the optical fibres and the insertion of diaphragms or shutters in the point of separation. It is also known to encase or not to encase the optical fibres accordingly at the end of the optical fibres facing the light source in order to eliminate non-parallel radiation, such that the radiation which does not extend parallel to the optical fibres is absorbed or emerges from the optical fibres. A physical action upon the transmitted light flux, in particular as a result of contact, does not then take place.

The object of the invention is to provide an improved switch.

According to the invention there is provided a switch, in which optical radiation from at least one radiation source is passed through photoconductors provided at least partially with sheaths to at least one radiation receiver and is acted upon, preferably manually, to produce a switching condition, wherein the photoconductors lie adjacent to one another on at least one contact surface and the adjacent photoconductors have no sheathing on the side lying opposite to the points of contact of the photoconductors with the contact surface.

Due to the lack of sheathing on the said side, it is possible to act in a physical and optical manner on the light passing along the photoconductors. In this respect a denser medium than that of the photoconductors, e.g. a finger or a cover, may be brought into contact with the points of the photoconductor which have no sheathing. In this way the total internal reflexion of the light in the photoconductors is cancelled out and the intensity of the light supplied from the radiation source to the radiation receiver is reduced.

The reduction of the constant light flux may be used to control an element performing switching via the radiation receiver and an evaluation circuit.

The cover may be constructed as a diaphragm which is resilient or resiliently mounted over the non-sheathed portions of the photoconductors in such a way that it may be pressed against these portions by a finger. The diaphragm enables a relatively tight seal against a mechanically and/or chemically active atmosphere and therefore against soiling. The arrangement may also be constructed such that all the elements of the switch are embedded in a block and are therefore protected against dust, water, gases and steam and such that there is only a slight air gap disposed in the deflection area of the diaphragm between the diaphragm and the photoconductors.

An advantageous embodiment of the invention is formed when the radiation source is associated with a pulse transmitter circuit and the radiation receiver is associated with a pulse combination circuit, both circuits being connected together.

In this way it is possible to operate the transmitter and the receiver in a synchronised relationship which ensures that during manual action upon the non-sheathed photoconductor portions at least one light pulse is transmitted from the radiation source and is received, after passing through the photoconductor, in a reduced form by the radiation receiver.

The pulse duration may be small with respect

to the remaining time. In this way it is possible to considerably reduce the power required for the operation of the radiation source and the radiation receiver without impairing the operational reliability of the switch.

The switch need not comprise only one element performing the switching and only one radiation source and one radiation receiver.

If several distant elements constituting the circuit are to be controlled, the radiation from a radiation source may be guided via photoconductors in different strands over different contact surfaces to radiation receivers, the same number of receivers being provided as the number of elements performing the switching and the receivers being connected via a common electronic coding and supply unit as well as a common decoding unit with the elements performing the switching.

The connection of the radiation receivers with the elements performing the switching via a common coding, supply and decoding unit is also possible, if each radiation receiver is associated with a radiation source. In this way the sensors controlling the elements performing the switching may be operated separately or several actuation elements may be operated at different locations when coded by means of a common line. This line may also be provided by the mains installation. The switch of the invention may be used in very difficult environmental conditions and may be operated with minimum actuating forces.

To help understanding of the invention, various embodiments thereof will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a side elevation in longitudinal cross-section of a switch according to the invention,

Figure 2 is a top view of the switch of Figure 1,

Figure 3 is an enlarged cross-section through a photoconductor lyingon a contact surface in the switch,

Figure 4 shows an electrical circuit arrangement for the switch,

Figure 5 shows an embodiment with one radiation source and several circuit elements,

Figure 6 shows a further embodiment with the same number of radiation sources and circuit elements.

The switch shown in Figures 1 and 2 has a support 1 provided with a contact surface 2. Embedded in the support 1 are a radiation source 3 with contacts 4, a radiation receiver 5 with contacts 6 and the ends of a photoconductor bundle 8 comprising optical fibres, shown in more detail in Figure 3. Each fibre 7 is provided with a sheath 9 and therefore forms a photoconductor, the fibres having a higher index of refraction than the sheath 9. The bundle of photoconductors 8 has its light input surface 10 attached to the radiation source 3 and its light output surface 11 attached to the radiation receiver 5 and is provided with a cylindrical shape in the vicinity of its light input and output surfaces. The photoconductor bundle 8 extends in a fanned out manner over the contact surface 2 in such a way that only one layer of photoconductors 8 is disposed on the contact surface 2.

On the side opposite to the contact surface 2, the photoconductors 8 have no sheathing in an area 12. Over the contact surface 2 there is disposed space from the area 12 of the photoconductors 8 a resiliently mounted membrane 2, whose spacing is determined by a spacer 2′ fastened to the support 1 and with which the diaphragm 2′ is rigidly connected.

The light emitted from the radiation source 3 as a continuous flux or pulse is received by the photoconductor bundle 8 via its light surface 10 and is supplied by total internal reflexion in the fibres 7 via its light output surface 11 to the radiation receiver 5. If the photoconductor bundle 8 is contacted in the area 12 for example when a finger presses against the bundle via the membrane 2′, whose index of refraction is greater than that of the fibres 7, the total internal reflexion is greater than that of the fibres 7, the total internal reflexion is cancelled out at the point of contact and the light leaves the fibres 7 at this point such that less or no light reaches the radiation rceiver 5 and no pulse is produced in the latter.

Referring to Figure 4, a light-emitting diode 13, which embodies the radiation source 3 of Figures 1 and 2 and is supplied with an operating voltage U_B, is connected to a current source 14, whose mode of operation is controlled by a pulse generator 15. In this way the light-emitting diode 13 is not continuously opereted, but is only operated during certain short-duration time intervals and the power consumption of the switch is thus kept low. In Figure 4 there is additionally shown a photo-converter 16 which embodies the radiation receiver 5 of Figures 1 and 2 and is supplied with an operating voltage U_B. The converter receives the radiation pulses emitted by the light-emitting diode 13 via photoconductors 8 of Figures 1 and 2 but which are not shown in Figure 3.

The photo-converter 16 is connected with a working resistance 17. Both the photo-converter 16 and the pulse generator 15 are connected to a logic circuit 18, which comprises a NAND gate 19 and an AND gate 20. Switching circuit element 21 is connected to and controlled by the output of the logic circuit 18. In the logic circuit 18 the signals arriving substantially at the same time from the pulse generator 15 and the photo-converter 16 are combined together such that the circuit element 21 only receives one pulse and its position changes, if the signal coming from the photo-converter 16 is not supplied or is not the same as that from the pulse generator 15. The AND gate 19 negates the signal coming from the photo-converter 16 such that in the case of an unaffected light pulse in the photoconductor it is inversely equal to the signal coming from the pulse generator 15, such that the AND gate 20 adds both signals to zero and no signal is transmitted to

the circuit element 21.

In Figure 5 several (six) photoconductor bundles 23 to 28 lead from a radiation source 22 to radiation receivers 29 to 34. A coding and supply unit 35 is connected on one hand with the radiation source 22 and the radiation receivers 29 to 34 and, on the other hand, via a supply and signal line 36, to a decoding unit 37. A number of circuit elements corresponding to the number of radiation receivers 29 to 34 is connected to the decoding unit 37, only the outer elements 38, 39 being shown in Figure 5 for the sake of simplicity in the drawing.

The coding and supply unit 35 supplies, via a supply line 40, the radiation source 22 which irradiates the photoconductor bundles 23 to 28 which are as shown in Figures 1 to 3 such that the radiation receivers 29 to 34 transsmit radiation signals to the coding and supply unit 35. The latter couples the radiation signals, for example as described with respect to Figure 4, and transmits the information in coded form as a function of the respective radiation receiver to the decoding unit 37 via the supply and signal line 36.

The decoding unit receives the coded information, decodes it and processes from this the command pulse for the associated circuit element 38, 39. For example the circuit element 38 may be associated with the radiation receiver 29 and the circuit element 39 may be associated with the radiation receiver 34.

In Figure 6 three radiation sources 42, 43, 44 are supplied by a decoding and supply unit 41, which sources are connected via photoconductor bundles 45, 46, 47 with radiation receivers 48, 49, 50. The light signals received via the photoconductor bundles 45, 46, 47 from the radiation sources 42, 43, 44 lead to electrical signals in the radiation receivers 48, 49, 50, which signals are coded in the coding and supply unit 41 and transmitted via a supply and signal line 51 to a decoding unit 52. The decoding unit 52 decodes the information transmitted by the signals and supplies it to circuit elements 53, 54, 55, as a result of which their switching positions are changed or retained. The arrangement is designed such that the circuit element 53 is associated with the radiation receiver 48, the circuit element 54 is associated with the radiation receiver 49 and the circuit element 55 is associated with the radiation receiver 50.

The above described switch may be used in many applications, is very reliable in operation and constructed in a simple manner. In addition it should not exert any long-term damaging effect on the human body. Being based on a purely optical principle it does not require any movable parts for its control and avoids the flow of electric current through the human body.

Further the switch is designed to actuate light sources, electrical and electronic appliances and for the input and output of data. It is designed for use in many applications, is simply constructed and has a high degree of reliability from the point of view of operation and service even in the case of very difficult or aseptic environmental conditions.

CLAIMS

1. A switch, in which optical radiation from at least one radiation source is passed through photoconductors provided at least partially with sheaths to at least one radiation receiver and is acted upon, preferably manually, to produce a switching condition, wherein the photoconductors lie adjacent to one another on at least one contact surface and the adjacent photoconductors have no sheathing on the side lying opposite to the points of contact of the photoconductors with the contact surface.

2. A switch as claimed in Claim 1, wherein a diaphragm is disposed in a resilient manner and with a spacing from the photoconductors lying on the contact surface, the index of refraction of this diaphragm preferably being greater than the index of refraction of the photoconductors.

3. A switch as claimed in Claim 1 or Claim 2, wherein a pulse generator circuit is associated with the radiation source and a pulse combination circuit is associated with the radiation receiver and in that both circuits are connected together.

4. A switch as claimed in Claim 1 or Claim 2, wherein several radiation receivers and the same number of contact surfaces are provided; the photoconductors are disposed adjacent to one another on each contact surface in order to connect the respective radiation source with its associated radiation receiver; and a common electronic coding and supply unit and a decoding unit are disposed downstream of the radiation receivers.

5. A switch substantially as hereinbefore described with reference to Figures 1 to 3 of the accompanying drawings.

6. A switch as claimed in Claim 5 in combination with an electrical circuit arrangement as described with reference to Figure 4 or Figure 5 or Figure 6.

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